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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/895,791	06/29/2001	Richard C. Flagan	41994/RAG/C766	5582

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EXAMINER

BOOTH, RICHARD A

ART UNIT	PAPER NUMBER
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2812

DATE MAILED: 05/22/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

P.S.

# Office Action Summary

Application No.

09/895,791

Applicant(s)

FLAGAN ET AL.

Examiner

Richard A. Booth

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 04 March 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-44 is/are pending in the application.
- 4a) Of the above claim(s) 11, 13, 14, 36-39 and 44 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-10, 12, 15-35 and 40-43 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 6.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

## **DETAILED ACTION**

### ***Election/Restrictions***

Applicant's election without traverse of the inventions directed to the particles being semiconductors, the deposition method of pyrolysis, and thermal growth in Paper No. 8 is acknowledged. Furthermore, it should be noted that claim 14 is dependent on claim 13 and both are directed to the non-elected embodiments. Therefore, the elected claims are claims 1-10, 12, 15-35, and 40-43.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-10, 12, 15-24, 32, and 34-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Canata et al., "Size Classification of silicon nanocrystals" in view of Wu et al., "A Method for the Synthesis of Submicron Particles" and further in view of Littau et al. "A Luminescent Silicon Nanocrystal Colloid via a High-Temperature Aerosol Reaction".

Canata et al. shows the invention substantially as claimed including a method for forming a stratum consisting of semiconductor particles, comprising the steps of: forming an original plurality of discrete semiconductor particles from one of a source of semiconductor material (see nanocrystal source of fig. 1) and a precursor for said semiconductor material, said original plurality of discrete semiconductor particles entrained in a gas and thereby forming an aerosol; classifying particles of said plurality of semiconductor particles having diameters within the range of 3-10 nanometers; and depositing said semiconductor particles on a substrate thereby forming a stratum of discrete, electrically isolated semiconductor particles on the substrate (see abstract and entire document).

Canata et al. fails to expressly disclose heating said aerosol to a sufficiently high temperature to densify said particles such that substantially all of said particles includes a density substantially as great as the bulk density of said semiconductor material and thereby forming a corresponding plurality of densified discrete semiconductor particles entrained in a gas, and forming an electrically insulating cover on each of said particles, thereby forming a corresponding plurality of insulator coated densified discrete semiconductor particles.

Littau et al. discloses a pyrolysis oven used to form the nanoparticles and a second oxidation oven used to form an oxide coating on the particles (see fig. 1 and section A, "Aerosol Apparatus"). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Canata et al. so as to form an electrically insulating cover on the nanoparticles as disclosed by Wu et al. because this is an effective method to oxidize the nanocrystals prior to their deposition on the substrate. Furthermore, Wu et al. discloses an aerosol forming reactor composed of sections in which the particles are heated to a sufficiently high temperature to densify said particles such that substantially all of said particles includes a density substantially as great as the bulk density of said semiconductor material and thereby forming a corresponding plurality of densified discrete semiconductor particles entrained in a gas (see temperature of zone 4 in fig. 1). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Canata et al. so as to include the sintering step of Wu et al. because this allows for the formation of a suitable aerosol for subsequent deposition on a substrate.

Claims 25-28, 33, and 40-43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Canata et al., "Size Classification of silicon nanocrystals" in view of Wu et al., "A Method for the Synthesis of Submicron Particles" and further in view of Littau et al. "A Luminescent Silicon Nanocrystal Colloid via a High-Temperature Aerosol Reaction" as applied to claims 1-10, 12, 15-24, 32, and 34-35 above, and further in view of Yadav et al., U.S. Patent 6,344,271.

Canata et al., Littau et al., and Wu et al. are applied as above but fail to expressly disclose using thermophoretic or electrophoretic deposition to form the nanoparticles. Yadav et al. discloses forming nanoparticles using either of the above mentioned deposition processes (see col. 14-lines 50-67). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Canata et al. modified by Wu et al. and Littau et al. so as to utilize the deposition processes of Yadav et al. because Yadav et al. shows these processes to be suitable processes to form nanoparticles.

Claims 29-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Canata et al., "Size Classification of silicon nanocrystals" in view of Wu et al., "A Method for the Synthesis of Submicron Particles" and further in view of Littau et al. "A Luminescent Silicon Nanocrystal Colloid via a High-Temperature Aerosol Reaction" as applied to claims 1-10, 12, 15-24, 32, and 34-35 above, and further in view of Tiwari et al., "Volatile and Non-Volatile Memories in Silicon with Nano-Crystal Storage".

Canata et al., Littau et al., and Wu et al. are applied as above but fail to expressly disclose implementing the nanoparticles in an eeprom including a tunnel oxide, a gate dielectric film over said stratum, and a gate electrode over the gate dielectric film.

Tiwari et al. discloses a nanoparticle based memory including a monolayer of nanoparticles on a tunnel oxide, a gate oxide over the nanoparticles, and a control electrode over the control oxide (see fig. 1). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Canata et al. modified by Wu et al. and Littau et al. so as to

implement the process into a non-volatile memory as suggested by Tiwari et al. because such memories can have a higher integration capability than conventional memory structures (see abstract).

Claims 34-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Canata et al., "Size Classification of silicon nanocrystals" in view of Wu et al., "A Method for the Synthesis of Submicron Particles" and further in view of Littau et al. "A Luminescent Silicon Nanocrystal Colloid via a High-Temperature Aerosol Reaction" as applied to claims 1-10, 12, 15-24, 32, and 34-35 above, and further in view of Junno et al., "Controlled Manipulation of nanoparticles with an atomic force microscope".

Canata et al., Littau et al., and Wu et al. are applied as above but fail to expressly disclose forming an ordered structure of nanoparticles using an atomic force microscope.

Junno et al. discloses using an atomic force microscope in order to position nanoparticles with high precision (see abstract). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Canata et al. modified by Wu et al. and Littau et al. so as to use an atomic force microscope to position the nanoparticles as suggested by Junno et al. because this allows for greater control of the formation of device features on the substrate.


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***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Richard A. Booth whose telephone number is 308-3446. The examiner can normally be reached on Monday-Thursday from 7:30-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling can be reached on 308-3325. The fax phone numbers for the organization where this application or proceeding is assigned are 308-7724 for regular communications and 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 308-1782.



Richard A. Booth  
Primary Examiner  
Art Unit 2812

May 19, 2003